OHIO'S ENGINEERING FIRSTS

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4. CHEMICAL INDUSTRIES

OHIO is indeed a versatile state; or, if you think a state can't be versatile, you must admit that its people are. Great and various things come out of Ohio, frequently. Chemically speaking, it can be said that this state has done as much for the people of the world as any other state, or something like that.

For instance, to make an old car look like new, wash it well with some of Cincinnati's soap and spray on some Cleveland paint using a Toledo spray gun. Put on some Akron tires and Columbus chrome-plated hub caps using a Fremont kit of tools. Fill up the Youngstown or Middletown sheet steel tank with Findlay gasoline made more potent by the addition of Worthington-developed anti-knock fluid made, perhaps, with Pomeroy bromine. Drive over the Genoa cement highways drained, maybe, by northwestern Ohio drain tile and Uhrichsville sewer pipe. Open the Toledo safety-glass windows and smell the good earth, made better by using Columbus lime and Cincinnati fertilizer. So it goes.

The towns mentioned are carefully plotted on the accompanying map. (That is, they would be if there were a map; but maps cost money and besides, who cares where they are, anyhow?) On this same map *should* be plotted Oberlin the home of Charles Hall of aluminum fame; Barberton and Rittman for matches; Steubenville, East Liverpool, and Zanesville for pottery; Lancaster and Newark for glass; King's Mills for explosives; and Norwood, just for fun.[1] Of course, these are not the only places in the state in which chemical industry has taken root, nor are these industries the only ones in these particular cities. Many other large or small towns have many other large or small chemical industries which do make a difference, large or small, in the state's industrial chemical output.

Petroleum

The oil industry has been peculiarly nurtured in Ohio. Henry Howe, Ohio's traveling historian, tells us that the first petroleum found in Ohio, "and perhaps the world" as he puts it, was found in Noble county near the town of Caldwell. That was in 1814 or 1816; (the worthy Howe must have nodded). The drillers were after salt brine and the presence of oil merely caused them trouble in making salt. However, after the Colonel Drake well was shot in 1859 over in Pennsylvania, people became interested in oil and the Caldwell section was developed, rapidly.

Whether or not the Noble county oil was the first found in the world is of small consequence compared with the effect one Cleveland youth had on the world's oil business. Before he got through, his organization was up before almost every important court in the country until it was finally squelched by the United States Supreme Court. His was the lustiest trust ever "busted." This country boy, John D. Rockefeller, was born in 1839 on a farm in central New York but moved to Cleveland before his fourteenth birthday. In 1858 he met a young Englishman, M. B. Clark, with whom he pooled his resources and started a produce commission business on the Cleveland docks. The war shortly benefited them greatly, monetarily.

Oil had been found in western Pennsylvania and because of Cleveland's proximity to the fields the town very soon became the center of the refining business. So, in 1862, when Samuel Andrews approached Rockefeller to back a refining venture, Rockefeller helped to the extent of $4000. Not long later, he had $100,000 in the refinery. In 1865 he sold his share of the commission business and put his money in the oil firm of Rockefeller and Andrews. They bought the oil from the wells, made their own barrels and supplies, and grew richer. They started a second refinery which they called William A. Rockefeller and Company; they opened a New York selling house; Andrews produced and Rockefeller sold.

Then, in June, 1870, all these smaller companies were combined into The Standard Oil Company, with a capital of one million dollars and John D. Rockefeller as head. Then the fun began. Standard Oil quietly organized the South Improvement Company which united all the Cleveland refineries into one organization to save them from competition from the "oil country" refineries; special freight rates were quoted by the railroads to help in this salvation. Getting special rates was a simple matter since several directors of Standard Oil and South Improvement Company were presidents of railroads. Refiners in Pennsylvania began shouting "Monopoly!" and all sorts of other things. They formed an independent petroleum refiners association to combat the evil of Standard Oil. Thereupon, Standard quietly organized in 1875 the Central Association, to bring into line such independent oil men as Standard wanted to include; the independents joined, or else. The independent organization was practically wiped out.

Other subsidiaries were formed, pipe lines laid, and refineries built, until 1882 when there were 14 companies entirely owned by Standard and 26 partly owned.

1. *Editor's Note*: The author's home town is Norwood. Hah!

A new type of organization was developed in that year, called the Standard Oil Trust, to signify that all the stocks, bonds and management of these subsidiary companies were held in trust by several men known as trustees for the benefit of the owners. More cries of "Monopoly!" Lawsuits and more lawsuits. Fights and scandals. Finally, however, on May 11, 1892, the trust was officially dissolved by the Ohio Supreme Court. The constituent companies went about their own business, supposedly.

Then, in 1899, the Standard Oil of New Jersey became a holding company, which, for all practical purposes, was the same as the trust. Things went on fightingly until 1906 when a suit was brought against the company in St. Louis under the Sherman Anti-Trust law. The company lost and in 1909 was ordered to dissolve. It appealed the case and re-lost to the United States Supreme Court on May 15, 1911. Since then there has been no more trouble. But it was fun while it lasted.

Ethyl

The game of "knock, knock" may have been started long ago when automobiles began operating quietly enough throughout the entire body so that the engine cylinder "knock" could be heard. The British, by the way, call this noise "ping." (*Ping* is also something one does in ping-pong which recalls that *pong* is something that one did in Mah-jong, so what?) Anyway, it was a problem. Loss of power, lowered efficiency, fewer miles per gallon, and higher cost of operation were just a few of the results of this "knock" in the engine.

What causes it? People are not quite sure. Some say that it is caused by too rapid combustion of the gas mixture in the cylinder; others say that it is caused by too slow combustion; still others insist that "knock" comes from uneven propagation of the combustion inside the cylinder. High-speed photography has made it possible to study the ignition and combustion of the gas in the cylinder by taking pictures through quartz glass cylinder walls. The pictures seem to indicate that uneven spread of the flame causes the noise which we call "knock."

Automobile manufacturers and oil refiners got busy in their laboratories to find out how to stop this inefficiency. Very little was known about what caused it and less was known about what might stop it. It was, in reality, an expensive game of "knock, knock" but without the inevitable answer. Playing the game in one large laboratory were Thomas Midgley, Jr., now of Worthington, and his helper. They had been told to find something that would bring about the desired results. They had worked for several months and had found very little, when the boss announced that unless the antidote were found very shortly the company would probably be needing new lab. men. Then things began to happen.

Midgley had found earlier, by scientific guesstimates, that the halogens and particularly bromine seemed to show promise of giving the needed answer. So, throwing science and a few other things out the window, he set to work trying something out of every bottle he had in the lab, starting near the halogens. After working feverishly for a comparatively short time, he hit upon the material which is now known as tetraethyl lead or just "ethyl." It is added to gasoline in very small quantities, but it does reduce "knock."

Thomas Midgley, Jr., has his office and a laboratory on the third floor of the Chemistry Building here on the Ohio State campus where he and his assistants are working on a number of chemical problems. This past January Mr. Midgley received the Perkin Medal of the Society of Chemical Industry for his outstanding accomplishments in antiknock motor fuels and safe refrigerants.

Hall, Aluminum, Oberlin

At a celebration in Washington, November 23, 1936, honoring the hundredth anniversary of the American patent system, the names of America's twelve greatest inventors were made public. Three of these were Ohio men. One of them was Charles Martin Hall of Oberlin, discoverer of the process for making cheap aluminum.

Hall, just 22 when he made his discovery in 1886, was the son of a village minister. He was always interested in chemistry, so he naturally majored in the science when he attended Oberlin College. Dr. Frank F. Jewett, his professor of chemistry, later told a meeting of alumni of Yale something about Hall and his work:

> "There was a little boy about 14 years old who used to come to the chemical laboratory frequently to buy a few cents' worth of glass tubing or test tubes or something of that sort . . . That boy was Charles M. Hall . . . After he had entered college . . . I took him into my private laboratory and gave him a place by my side, discussing his problems with him day to day.
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> "Possibly a remark of mine . . . led him to turn his special attention to aluminum. Speaking to my students I said that if any one should invent a process by which aluminum could be made on a commercial scale, not only would he be a benefactor of the world, but he would also be able to lay up for himself a great fortune. Turning to a classmate, Charles Hall said: 'I'm going for that metal.' And he went for it."

Work had been done by Henri Deville for Napoleon in France and by Robert Bunsen in Germany in making a little aluminum by electrolyizing melted cryolite from Greenland. (Cryolite is a sodium-aluminum-fluoride.) But they decided that the process had no commercial possibilities. Hall did the same thing but added alumina to the melt and kept on adding it, making a continuous process. The earth's crust is full of alumina, an aluminum oxide, but no free aluminum, so Hall's method found widespread use. A famous patent infringement suit was decided in Hall's favor, so he was further able to fulfill his professor's prophecy of laying up a great fortune. When he died in 1914, Charles M. Hall left a fortune of $27,000,000, a third of which, incidentally, went to his alma mater, Oberlin College.

Aluminum ingots now are worth about 25 cents a pound. In 1879 an American who wished to buy a pair of opera glasses was told that aluminum or platinum mountings could be had for the same price. Prices, due to the work of this Ohio boy, have changed.

Rubber, Dirigibles

Akron (fr. Gr. *elevation*) in the Summit (County) of the state is only too well-known as the center of the world's rubber industry. It has been the center ever since the first rubber manufactory in the United States was started there in 1870 by B. F. Goodrich to make bicycle tires. One plant attracts another, so that the town soon became the rubber capital of the world. (To be sure matches and Quaker Oats are made there, too, but they don't hold a candle to the rubber business.) Lately, however, the good citizens of Akron have gone up in the air, more than just nominally, over the prospects of some of the plants going elsewhere for expansion. Labor, "they say," is the cause.

It is interesting (or maybe it isn't) to find that the first sit-down strike in the country came off in Akron and in one of its large rubber plants, at that. Dale Cox, in the Cleveland *Plain Dealer* for January 1, 1937, says that "it occurred at the General Tire and Rubber plant in Akron, June 17, 1935. . . . It was a purely spontaneous action by General Tire employees, who didn't realize until afterward what a new technique they had started. There seems to be no connection between the French use of the sit-down and its use over here, although it was used in France decades ago."

Since the rubber was already in Akron it was just a step, but a very big one, to rubberized fabric for dirigibles. Various factors entered into the selection of Akron as the airship-building center of the country. Goodyear organized the Goodyear-Zeppelin Corp. which then erected the cavernous hanger south of Akron and presently built the largest lighter-than-air craft that ever flew. Unfortunately, neither one flew very long. There is another movemnts afoot to begin building another airship at the Akron hangar, but what comes of the plan is yet to be seen.

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Which leaves us decidedly up in the air, just where we were when we tried to decide which of Ohio's many chemical (or allied) firsts should be included in this brief article. Yea, verily, Ohio is so chemically complete that perhaps some one ought to write a book about it. Someday, maybe, one of Ohio's enterprising engineers will do just that.